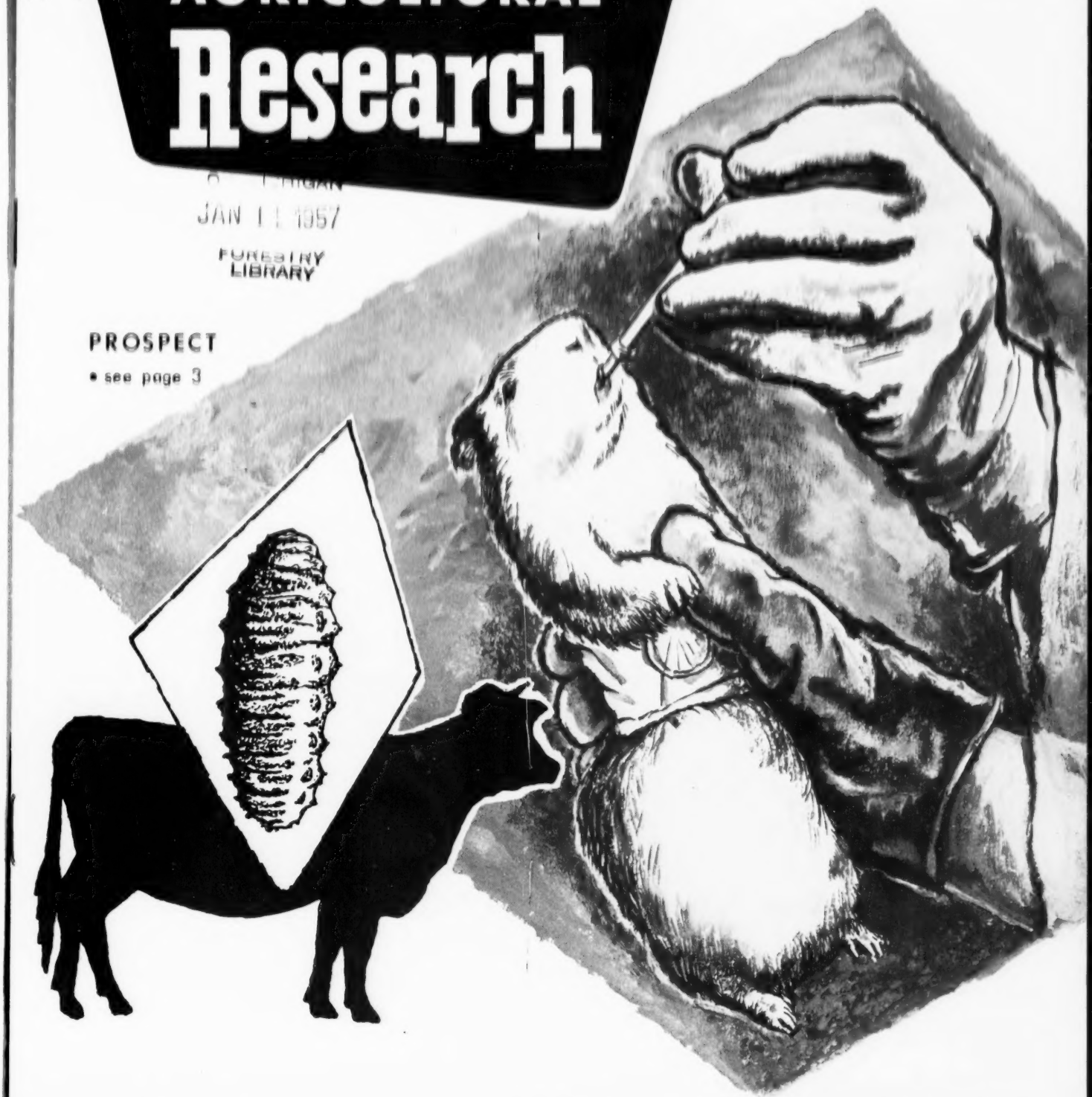
Forestry

PR

AGRICULTURAL Research

DECEMBER 1956



PROSPECT

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UNITED STATES DEPARTMENT OF AGRICULTURE

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AGRICULTURAL
Research

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CONTENTS

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Time

A recent news story from London reported successful use of a predatory fungus to destroy plant pests—a finding that may save British potato farmers some $5 million a year.

Now it happens that the original investigations of the microscopic organisms were made 20 years ago by a scientist at the ARS Agricultural Research Center, Beltsville, Md.

This story points up the fact that what we are accomplishing today rests on basic knowledge we learned yesterday.

And accomplishments 20 years from now may depend on fundamental facts we discover in our laboratories this year.

In attaining our present productivity, we have been reworking our fundamental information to the point of exhaustion. It's time to turn our minds, skills, facilities, and money to replenishing our supply of fundamental knowledge.

To feed the expected population of 1975 and later years, we will have to increase yields per acre, per animal unit, and per man hour. We will need research to do it.

We have done a lot of work on how to grow crops. But we need to learn more about *how crops grow*. There are big gaps in our knowledge of the basic characteristics of plants and their growth. Why are plants resistant to disease? Much work with fertilizers, chemicals for weed and insect control, and water will depend on what we learn about plants.

It's much the same with livestock. There are many basic questions to be answered in genetics, animal nutrition, and disease control. What part does nutrition play in development of good flavor and tender beef, and how much depends on heredity? The shift to animal agriculture means that animal diseases are going to demand greater consideration.

Fortunately, our great abundance has bought us time to do basic research. It is up to us to use this time to prepare our agriculture for other emergencies before they arise.

One of our Medfly weapons is a lure made of oil of angelica seed. This lure was discovered at the ARS laboratory in Hawaii only a month or so before the Medfly was found in Florida! That's how close the race sometimes is. It would not have been won without many years study of insect physiology.

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SOON—A LIVESTOCK SYSTEMIC

Insecticide that is given orally and moves through animal's body may be our answer to cattle grub

■ FINDING AN EFFECTIVE systemic insecticide for livestock insect control has been a hope of our entomologists for at least half a century.

Success of recent tests on one such insecticide—Dow ET–57—gives every indication that scientists are at last realizing this ambition.

Extensive cooperative research by Federal, industrial, and State scientists has demonstrated this chemical's great promise for controlling and maybe eliminating cattle grub, one of our country's costliest and most troublesome livestock pests.

ET–57 is an organic phosphate chemical, 0,0-dimethyl 0-2,4,5-trichlorophenyl phosphorothioate. When one dose is given orally to an animal, the chemical moves throughout body fluids to destroy both northern and common species of grubs before they break through the hide and appear in the backs of infested cattle.

Early results are confirmed

Previous preliminary research had shown that ET–57 was effective in killing grubs (AGR. RES., July 1956, p. 15). More recent work has confirmed earlier results and, in addition, has given a more comprehensive picture of ET–57's capabilities as a possible control for cattle grub.

As experimentally used—100 milligrams per kilogram of animal weight, or 1.6 ounces for a 1,000-pound animal—the chemical had no visible effect on the animals treated.

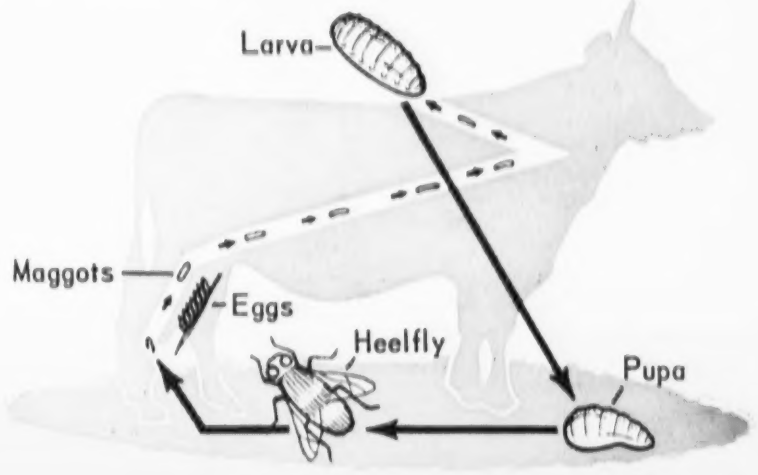
ET–57 is not available commercially. Though researchers have amassed considerable data, they feel that at least another year is needed to fully investigate additional details of the chemical's use—entomological performance under wide geographical areas, toxicological effects on treated animals, residues in meat and dairy products, how it travels within the animal's body, and practical means of administering the insecticide.

Research by entomologists, veterinarians, and chemists of USDA's Kerrville (Tex.) and Corvallis (Oreg.) stations, by Dow Chemical Co., and by several State experiment stations made possible the development of ET–57 as a systemic. Although it is still too early to recommend this chemical as a control for cattle grub, ARS researchers are enthusiastic over its possibilities.

Dose effective, not harmful

In the tests, one dose of ET–57 was sufficient to kill 92 to 100 percent of all grubs within a few days after dosing, before they broke through the hide. Doses of 100 mg./kg. of animal weight seemed to be effective and caused no harm. Doses from 150 to 200 mg./kg. caused toxic symptoms but animals recovered rapidly. Treatments were made from 2 to 5 months before the grubs normally appeared in the backs of animals (or just after the heel-fly season ends). One dose

HEEL FLIES begin to chase cattle to lay their eggs on the short hairs of animals' heels with the advent of the first warm days of spring. Cattle run frantically to escape these insects that cannot bite or sting. In a few days, eggs hatch and larvae burrow into the skin. For about 8 months, larvae migrate through various body organs, muscular tissue. They reach the surface of the skin on the animal's back, where they stay from 35 to 60 days, breathing through holes they make in the skin. They mature, leave the animal, fall to ground. Larvae burrow into the ground, emerge 3 to 11 weeks later (depending on temperature) as heel flies.



also got rid of cattle lice and killed biting flies for 2 or 3 days. Tests so far show that ET–57 is not especially effective in controlling internal parasites. Further research along this particular line is planned.

ET–57 was administered orally by drench, capsule, and bolus (a hard, cylindrical mass of compressed insecticide). Scientists are also investigating other ways to give the insecticide—spraying the animal with a liquid preparation, subcutaneous injection, and various oral methods.

Tests so far show that long-lasting residues are not likely to occur in the meat of treated animals. Fifty parts of the chemical per million were present in the fat of animals slaughtered 3 days after treatment. This dropped to 7 parts per million after 14 days. More work is being done to further define the time limit between treatment and slaughter.

Not suitable for milk cows

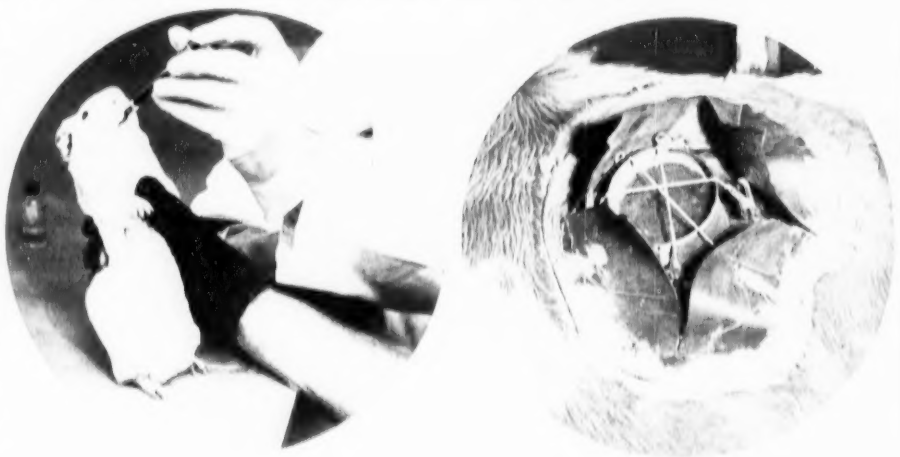
Radiological tests showed that ET–57 was present in the milk of treated cows for several days. This suggests the unlikelihood of developing ET–57 for use with milk cows. Rotenone is still regarded as a simple and effective material to treat cattle grubs in producing dairy animals.

Work is still underway to determine the effect of ET–57 on meat flavor. Preliminary study by several taste panels, however, indicates that off-flavor in the meat is not likely to be a problem with this insecticide.

USDA research on systemic insecticides for controlling cattle grubs has been underway since 1947. Some of the chlorinated hydrocarbons—dieldrin, aldrin, lindane—were first shown to have systemic action. They had to be discarded, however, because they required repeated treatments and left excessive residues. Phenothiazine, reported as promising, has been tested extensively by State and Federal workers. Results show that it is not an effective systemic.

Currently, the search for new and even more effective systemics is continuing. Much work is being done on other materials given internally or even applied externally. Among the most promising of those used externally is Bayer 21/199. Applied as a spray in preliminary tests, it prevented the development of grubs after they entered the body. ☆

Long-range screening reveals systemic behavior of new chemicals . . .



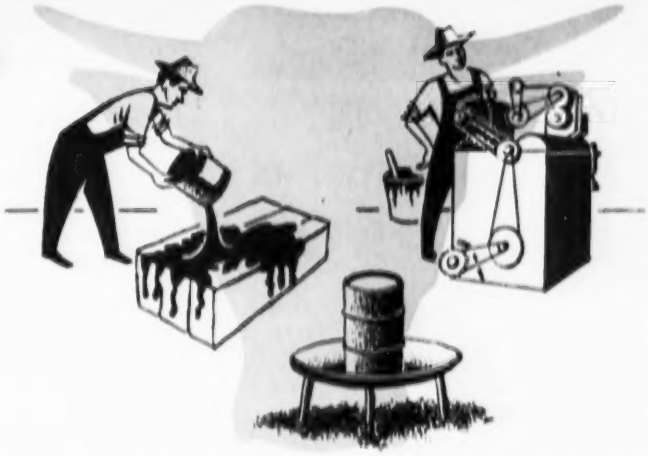
GUINEA PIG gets dose of new experimental compound (right) in initial screening tests at Kerrville, Tex. Entomologists here have been screening hundreds of compounds for systemic action in last 10 years. Guinea pigs are used owing to the high cost of livestock and small quantities of new chemicals. Their systemic effectiveness is tried routinely on three insects—screwworms, biting flies, ticks. Insects feed on treated animals at various intervals after treatment. Compounds showing systemic action are later tested on cattle (far right). Biting flies in cages are exposed to treated cattle. Rubber pieces protect against loss of cages. Promising systemics are then studied to find safe dosage rates for cattle.

Most promising get radiological test for residues, elimination, action

RADIOACTIVE ET–57 is given to animal by drenching, using a drench gun (right). Geiger counter, held by worker in center, keeps constant check on radioactivity. Radioactive ET–57 was given to cattle to determine residues remaining in various tissues and in milk, rate of elimination from animal's body, how it travels within the animal, how it kills grubs. Blood, urine, feces samples were tested at intervals. In one test, animal was slaughtered after 14 days and tissue samples tested (far right) by chromatographic analysis of treated paper strips. Nearly 86 percent of ET–57 was excreted in urine 60 hours after a treatment. After 96 hours, only small traces of original ET–57 were found, plus 2 breakdown products.

FARMERS ARE FEEDING MORE *Molasses*

Blackstrap makes poor roughage more palatable, promotes digestion, gives nutritive value, say users, who feed it to livestock in a variety of ways



■ THE QUANTITY OF CANE blackstrap molasses used in livestock feeding is increasing and the number of farmers, ranchers, dairymen, and feedlot operators buying supplies is growing, according to a USDA survey.

Farmers add molasses to make livestock feeds more palatable, just as cooks add sauces to make foods more delectable. Results: Appetites are stimulated, more foods are consumed.

Molasses—3 to 5 pounds a day per 1,000 pounds of body weight—promotes consumption of coarse roughage that might otherwise go to waste. When higher quality roughage is not available, adding molasses promotes efficient digestion through stimulation of rumen microorganisms. Thus, blackstrap increases the value of coarse roughage to a limited extent.

Like corn, molasses is a good carbohydrate source. There are also minerals, niacin, and pantothenic acid, plus a bit of protein, to increase the feed's nutritive value. Molasses acts as a binder when mixed with dusty or finely ground feeds, decreasing feed losses caused by scatter.

Study explains molasses use

These reasons for using more molasses were brought out in a survey conducted by Agricultural Marketing Service, under supervision of agricultural economist C. B. Gilliland.

Wholesale molasses prices at port terminals have been below corn costs in 12 of the last 14 years (6½ gallons of molasses equals a bushel of No. 3 yellow corn). With the recent increase in demand for molasses, however, prices have gone up. Prices paid by users vary according to the distance from supply, method of delivery, and unit volume of delivery.

Storage setup varies widely

Storage facilities vary from a single drum to a large tank holding several thousand gallons. Facilities depend upon the user's requirements and the supplier's delivery practices. Farmers who have 2 or 3 drums and are on a regular delivery route have the containers refilled twice monthly. Other users with larger facilities have only one delivery a season.

At optimum feeding rates, a 3,000-gallon tank load lasts a herd of 70 cattle roughly 100 days—the length of the nongrazing period in many areas. Smaller herds have a carryover of molasses to the next season.

Some users pour the molasses on the grain or roughage. Others give the animals access to an unlimited amount of liquid molasses. Still others own mixing mills to combine molasses with chopped hay and grains that are being fed.

In areas affected by drought and reduced forage, users look on molasses as the least expensive method of feeding livestock in emergency periods. Some users combine roughage with urea-supplemented molasses or with high-protein concentrate. They report weight gains at a cost reduced as much as one-third from the costs when fed the regular grain, hay, and protein concentrate.

Farmers who provide unlimited liquid quantities of molasses find that cattle have a tendency to overeat the first few days. If the amount is restricted at the beginning, animals will consume a normal quantity without any form of restriction when they become accustomed to the taste.

Cattlemen who sprinkle molasses on roughage for small herds up to 10 animals use only a drum set on a stand. The drum should be sheltered from weather to prevent expansion from summer heat and to make it easier to draw molasses in winter cold.

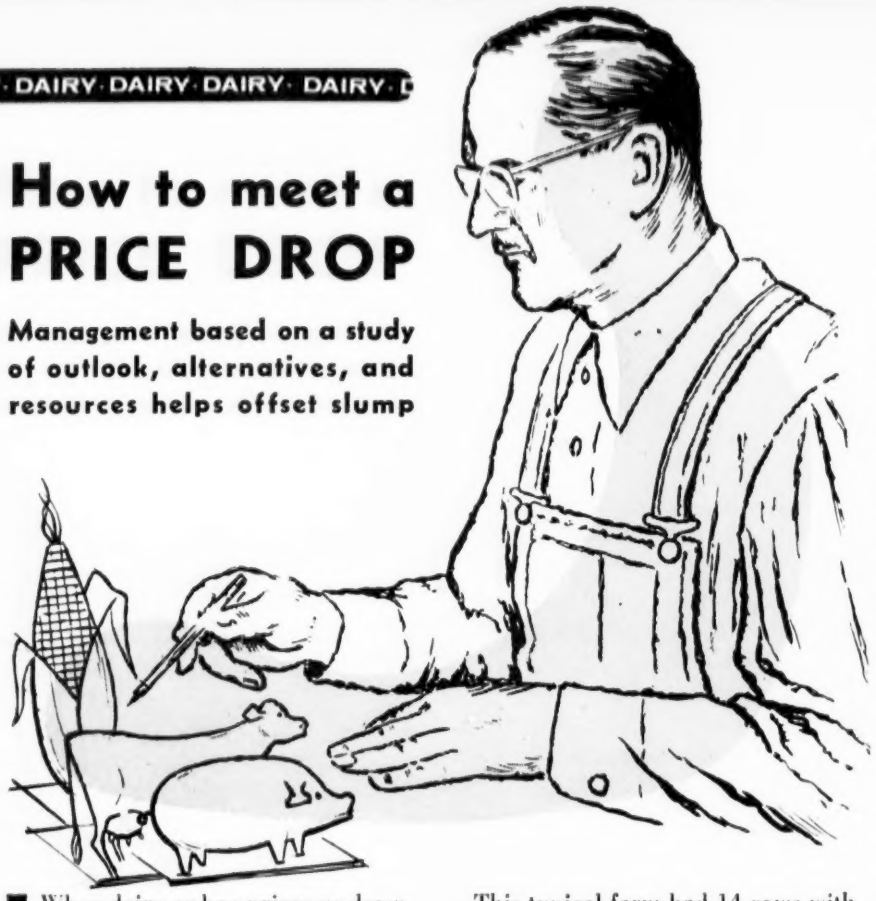
Method saves time and feed

Open-range cattle feeders in the Southwest haul baled hay and molasses to feeding points and change from daily to every-other-day feeding schedules. Undiluted molasses is poured on each bale and allowed to soak into the hay. Cattle chew the unopened bales and by the second day the twine loosens. But the molasses-moistened hay stays in place until eaten, decreasing losses from trampling and from scattering by wind. Usually, moistened feed is completely consumed.

The survey shows that molasses increases the appetite as much when poured over feed as when mixed with feed or fed in unlimited quantities. ☆

How to meet a PRICE DROP

Management based on a study of outlook, alternatives, and resources helps offset slump



■ When dairy or hog prices go down, so does a dairy-hog farmer's income—that is, unless he can adopt more efficient management practices.

USDA researchers have found ways of even raising returns of a typical dairy-hog farm despite price cuts up to 20 percent. The key—familiar to county agents—is better management of land, equipment, and labor.

A dairy-hog farmer may find the solution in better understanding of his farm resources, alternatives for using them in other lines of production and the economic outlook.

Dairy-hog operation studied

A 160-acre dairy-hog farm typical of operations in northeast Iowa was used as a basis for devising such alternatives. They were worked out by agricultural economists Frank Ozarem and R. V. Baumann, of ARS, and E. O. Heady, of the Iowa experiment station. The results are applicable to thousands of dairy-hog farms.

This typical farm had 14 cows with annual dairy-product sales of $3,080. Other income included $5,054 from 126 hogs, $797 from poultry, and $350 from corn. The farm's net income amounted to $4,585 per year.

Drop in milk prices assumed

Under the first alternative devised by economists for use in case of a 20-percent drop in milk prices, the dependence on dairy products as a source of income was reduced to $2,232 with 12 cows. The dependence on hogs was increased to $6,357 with 153 hogs. Poultry totaled $1,057, corn $1,016. Crop yields were increased by more intensive grain production—corn-corn-oats-meadow rotation, terraces to control erosion, and use of fertilizer. The farm's net income was $4,996, or $411 more than before the drop in dairy prices.

Profits would be even greater if farmers also concentrated on improving the efficiency of their dairy enterprises. Better breeding, feeding, and sanitation, as well as better use of labor, could boost net returns.

In addition to increasing present profits, farmers would be preparing for an expected upswing in the demand for dairy products as the population of the United States grows.

Hog price slump considered

If a 20-percent decline occurred in hog prices rather than in milk prices, this dairy-hog operator would have another choice. He could sell corn—which sometimes provides a greater return—instead of feeding hogs. (Farmers who use 8 or more bushels of corn to produce 100 pounds of pork would be better off if they stopped raising hogs and used their resources in other enterprises.) The same cropping system suggested under the first plan could be used.

Still another course would be open to the dairy-hog farmer. He could investigate the possibility of improving the efficiency of his hog production to save feed and thereby increase his sales of corn. The farm income from this plan exceeded the income obtained from the typical plan despite 20-percent lower hog prices.

Farmers who are already efficient in hog production (saving an average of 7 or more pigs per litter and producing 100 pounds of pork with 6 or fewer bushels of corn) would suffer a loss in income from lower hog prices. But such operators would not find themselves in as severe a price squeeze as the less efficient farmers.

A dairy-hog operator should compare the prices of feed and other resources with prices he would get for milk and pork. Then he should select the most efficient farming plan considering the *relative* level of prices—not the absolute level.

The county agent, with planning resources at his command, can be a big help to farmers who must adjust to a changing market situation. ☆

WHY IRRIGATED CORN LODGES

Thicker planting, heavier usage of nitrogen make stalks taller, ears higher and heavier

■ STALK BREAKAGE (lodging)—a serious problem of corn in the irrigated West—has worsened in recent years and USDA-State research shows why. Two modern trends—to thicker planting and heavier applications of nitrogen—apparently have increased lodging as they raised corn yields.

Sometimes up to 60 percent of the stalks in a field break before harvest. Mechanical pickers will miss most of the ears on down stalks.

ARS and the Washington experiment station studied this problem jointly. Soil scientist C. E. Nelson, who made the studies last summer at Prosser, Wash., thinks that greater height and weight of ears on the stalk and greater stalk height may be responsible for the breakage. Both fertilizing with nitrogen and growing plants closer together cause corn to grow tall. But nitrogen also increases the diameter of the stalk as well as its resistance to breakage early in the season. It might be assumed, therefore, that high nitrogen would protect stalks against breakage. On the contrary, the greater weight and bulk higher up more than offsets the advantage of greater stalk thickness and causes the stalks to break.

When plots received 100, 200, or 400 pounds of nitrogen to the acre—all heavy rates—30 to 32 percent of the stalks broke naturally by harvest time. But only 23 percent of the stalks broke on the unfertilized plots. Increased lodging therefore appears inevitable with the use of high levels of nitrogen fertilizer.

In the plant-population study, natural breakage under low nitrogen fertility ranged from 8 percent at 9,300 plants an acre to 46 percent at 26,200 plants an acre. Under high nitrogen fertility, breakage was 15 percent at 9,300 plants, but was 60 percent at 26,200 plants to the acre.

Breakage at top yield noted

Maximum yields of grain were obtained at about 20,000 plants an acre for both high and low nitrogen fertilizer levels, with 49 and 37 percent stalk breakage respectively.

Deep cultivation versus shallow cultivation and hilling versus no hilling had no effect on stalk breakage.

Potential break tests tried

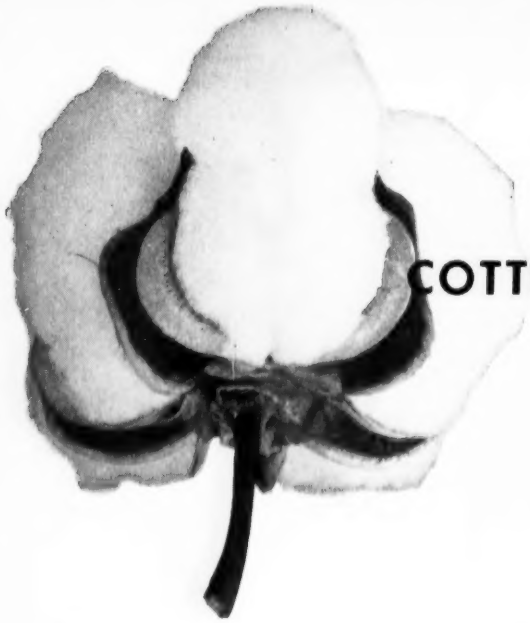
Three possible tests, to forecast breakage likely to occur after the stalks dry, were tried on green stalks in the last week of September: (1) mechanical force necessary to bend a standing stalk to the breaking point; (2) amount of force necessary to break the third internode of the stalk between 2 supports 6 inches apart; and (3) diameter of third internode. The second of these tests was found to have the best potential for predicting late stalk breakage.

Nelson and his associates think it would be tremendously helpful to farmers if they had a good test that could warn them earlier in the fall of an impending stalk-breakage problem. Then they could be forewarned to irrigate up to the middle of September so the stalks would not dry out prematurely, and to harvest their crop at the earliest possible date. ☆

SPARSE STAND of corn, 9,300 plants an acre, let in plenty of sunlight, so the stalks grew strong without any fertilizer. Nitrogen makes ears and stalks heavy. Only 8 percent of the stalks in this plot broke.

MEDIUM STAND of 12,900 plants an acre, strongly stimulated by 200 pounds of added nitrogen an acre, had many more down stalks. Fields like this are mechanically picked, then gleaned by hand or by livestock.

OVERPLANTING at 26,200 stalks to an acre made field a shambles. Competition and shading weakened the stalks, while nitrogen boosted yield and weight of ears. The field would be difficult to harvest, even by hand.



COTTON'S *Good-Luck* PLANTS

Scientists are searching for more of these rare, fatherless twin seedlings that are so helpful in development of better cotton and other research uses

■ FIND TWIN COTTON plants—two plants growing out of a single seed—and you may bring good luck to the cotton industry and to the country.

One of the twins will likely be a rare fatherless plant called a haploid. A score of haploids have come into the hands of USDA cotton breeders. Two such plants have been the means of breeding into our cottons the desirable characters of lint strength and length, early flowering, boll prolificacy, and leaf smoothness.

ARS and State plant breeders at the Delta Branch Experiment Station, Stoneville, Miss., are anxious to get many more twins for research. They hope seedsmen and cotton breeders will keep on the lookout for them.

Weak twin may be haploid

Where twinning occurs, one of the plants will be normal. But the other, a weakling, will usually be a fatherless one—a sort of "half plant." Its cells will contain only the one set of chromosomes and genes (inheritance vehicles comprising the chromosomes) handed down from the mother. It will have none of the set a male parent normally supplies.

Normal cotton is *diploid*—that is, it has 2 sets of chromosomes, in contrast to the *haploid*, with just 1 set. In upland cotton, haploids may occur in one seed out of a million, or possibly less often. Being weak, haploids rarely survive in the field, so you're not likely to see such a freak unless you're sprouting seeds in a germinator. That's why so few have come into the hands of our researchers.

Drug doubles chromosomes

Haploids are incapable of sexual reproduction—cannot set seeds. In such plants, a mother cell from which pollen or egg cells should arise has only one of each kind of chromosome instead of the usual pair. Dividing these chromosomes among pollen or egg cells would supply each with an incomplete set of chromosomes—not enough for viability. ARS geneticist J. R. Meyer at the Stoneville station solved the difficulty, however, by treating haploid plants with the drug colchicine and causing the doubling of chromosome number in the cells.

Doubling the chromosomes caused new tissue in treated plants to have all chromosomes in pairs, as is normal in sexually perfect plants. Unlike the usual pattern, however, both members of the chromosome pairs are identical. Geneticists call such plants homozygous—that is, they breed true. After several generations of inbreeding, normal plant material approaches the homozygous state but never quite attains genetic purity.

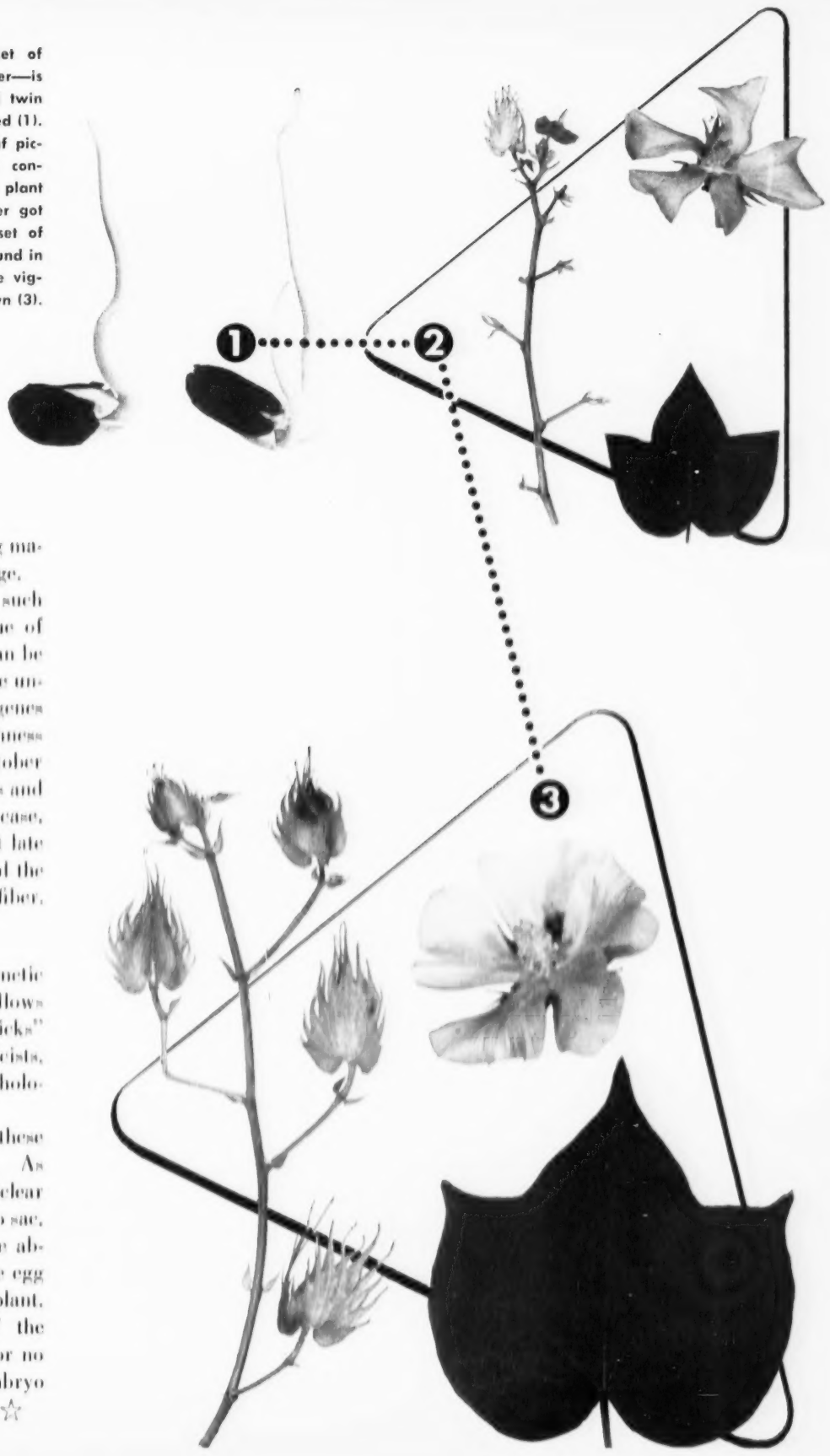
The real merit of these doubled haploid plants is that they give rise through self-fertilization to offspring that are identical to them, just as though they had been increased vegetatively. So, without character change or the progressive weakening that generally results from protracted inbreeding, the stock can be maintained in pure form for many generations. Meyer has, however, protected against loss of homozygous character by mutational change. He did this by keeping the original undoubled haploid material alive through a series of grafts onto new rootstocks.

Work leads to new advances

Meyer's work with this material has had three practical results.

First, a crossing of the doubled Stoneville haploid Z 106 with the doubled Deltapine haploid 3948 produced a hybrid vigor substantially greater than in normal hybrids of those or other cottons. This invites some interesting speculation. If hybrid cotton ever becomes a practical

HAPLOID SEEDLING with just one set of chromosomes—half the normal number—is weaker from the start than its normal twin shown here emerging from the same seed (1). The small, weak plant, flower, and leaf pictured (2) give evidence that frailty continues to mature life—if, indeed, the plant even lives. Plant breeder J. R. Meyer got such a plant to duplicate its single set of chromosomes and match the number found in a normal plant. This gave rise to the vigorous doubled haploid plant that's shown (3).



reality, doubled haploid breeding material offers additional advantage.

Second, doubled haploids give such stable test results that true value of new characters bred into them can be measured by comparison with the uncrossed material. Meyer bred genes for fiber strength and for smoothness of leaf and stem (AGR. RES., October 1954, p. 5) into doubled haploids and proved substantial gain in each case. But comparison also proved that late opening of the balls accompanied the cotton's increased strength of fiber.

Plant is living yardstick

Third, the complete lack of genetic variability of doubled haploids allows them to be used as "living yardsticks" for work by agronomists, geneticists, cytologists, physiologists, pathologists, and soil scientists.

It's interesting to know how these odd haploid plants can arise. As Meyer explains it, two extra nuclear cells lie near the egg in an embyro sac. These nuclear cells normally are absorbed for nourishment after the egg is fertilized to form the new plant. Occasionally, however, one of the cells, without fertilization and for no obvious reason, forms an embryo and plant—the haploid twin. ☆

WHAT DAY LENGTH MEANS TO TREES

■ LENGTH OF DAY has a lot to do with the way trees grow, but USDA studies show that different species behave quite differently under a given number of hours of light a day. That partly determines what kinds of trees grow naturally at a given latitude.

ARS scientists R. J. Downs and H. A. Borthwick, working at the Agricultural Research Center, Beltsville, Md., found most of their test trees stopped growing after being cut back to 8 hours of natural light. The tulip poplar, for instance, stopped stem growth after only 10 days of short-duration light, and most species within about 4 weeks. The American elm, on the other hand, stopped growing only after 140 days of 8-hour light. This explains why elms in the latitude of Washington, D. C., often have limb tips killed by frost.

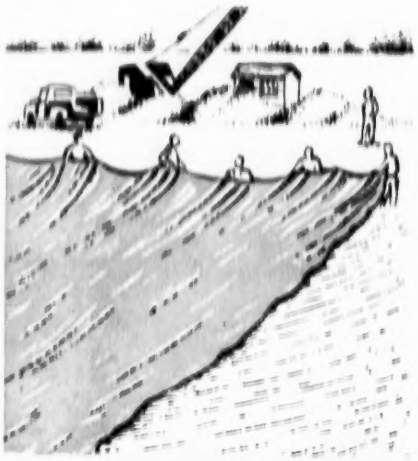
With only light duration changed and summer temperatures continued, leaves generally took on some autumn tinge but did not shed. Lowering the temperature, however, invariably checked growth and caused leaves to color regardless of light duration.

Lengthening of the day again to 16 hours—that is, 8 hours of sunlight plus 8 hours of supplemental light—caused the inactivated catalpa, birch, and tulip poplar trees to resume growth provided the daylight was lengthened soon after growth stoppage. But it took continuous light to make sweet gum grow again.

Stripping off leaves was another device found to cause some trees—sweet gum and paulownia—to resume growth immediately. But that measure didn't cause regrowth of dogwood, elm, or catalpa. Again, the rate and duration of growth, when it occurs, are governed by day length.

The trees grew normally under fluorescent light. But they grew twice as tall under the household-type incandescent light, owing to its far-red component, which has a wave length just longer than red.

These findings are an addition to the fundamental knowledge gathered in a long investigation of light's role in plant life. Ultimately, practical light uses may emerge for our tree breeders, nurserymen, and others, just as light-based practices have come into use in other plant fields. ☆



FILM LOOKS GOOD AS RESERVOIR LINER

■ VINYL AND POLYETHYLENE films have shown distinct promise in recent USDA research as water-tight liners for farm reservoirs. Many reservoirs are constructed in porous soils and some type of lining is desirable.

ARS soil scientist C. W. Lauritzen and cooperating researchers in the Utah experiment station learned from preliminary tests at Logan, Utah, that films as thin as 8 mils (.008 inch) may be as efficient and durable as other membrane liners and more so than some used. With current prices at about 10 cents per square yard for 1-piece plastic liners and low installation costs, such liners compare well in cost with others now used.

Black polyethylene withstands the sun's actinic rays without deterioration and weathers well. Under some conditions, it may be used without covering. Even a 4-mil film was used successfully when laid with extreme care on a smooth bed of uniform sand and covered with the same material.

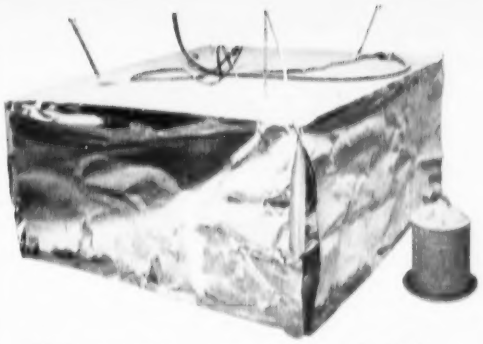
Polyethylene films are, however, more difficult to repair than vinyl.

These films have many assets. They are resistant to biological deterioration in moist soil. The polyethylene film in particular is resistant to penetration by the roots of alfalfa, quackgrass, or cattails common at the edge of ponds and canals. Both films withstood a 70-foot head of water when supported on a subgrade of rounded ¼-inch gravel. The films yielded, leaving the imprint of each stone or pebble, but didn't rupture.

Such films are damaged, however, by sharp objects. Because of this, precautions must be taken to remove trash and cover sharp, coarse, gravelly material with fine-textured earth when installing these films.

Similar precautions must be taken when covering liners. The first few inches of material on the film must be fine-textured and free from sharp objects. To maintain the cover, it's necessary to top the fine-textured material with a layer of gravel or other erosion-resistant material.

Normally, only the side slopes need be covered. In such cases, however, the outlet must be elevated to leave about 1 foot of water on the bottom to hold the plastic film in place when the reservoir is drained. ☆



Curtains Cut Costs

Fitting infrared lamp brooder with right kind of curtains results in a big saving

■ RECENTLY CONCLUDED USDA-State experiments show that the cost of brooding chicks in an infrared-lamp brooder can be cut by about half if the brooder is fitted with curtains.

This means a saving of about 2 cents a chick, according to ARS engineers J. G. Taylor and E. A. Johnson, who conducted the experiments at Lafayette, Ind., in cooperation with the Purdue experiment station.

Over a normal 11-week brooding period, researchers Taylor and Johnson found no significant differences in gains and feed efficiency between chicks reared in brooders with or without curtains. But the "control" brooder—without a curtain—required almost 93 percent more electrical energy than curtained brooders.

Plastics and aluminum tried

Similar results were obtained in brooders fitted with curtains made of white vinyl plastic, clear vinyl plastic, and 32-gauge aluminum sheeting. The clear plastic curtains gave the added advantage of visibility.

Various lamp controller systems used in the experiments were the proportional-time modulator, a commercial brooder wafer type, and a commercial high-sensitivity thermostat. The proportional-time modulator type gave a slight cost advantage, amounting to 0.2 cent a chick better than the commercial high-sensitivity regulator and was 0.9 cent a chick better than the wafer-type thermostat.

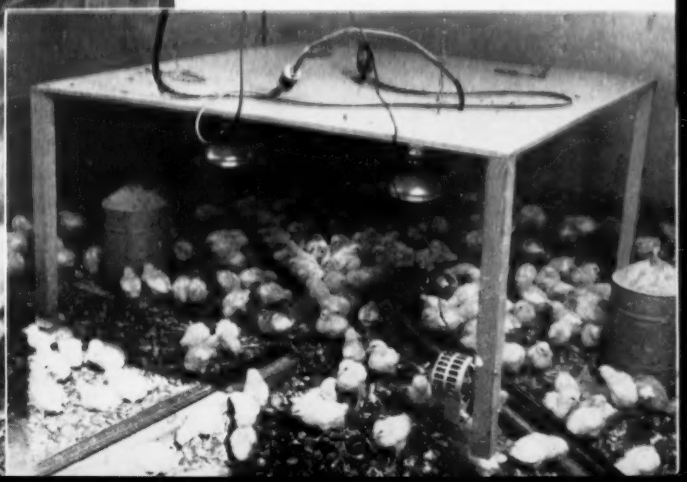
Use of curtains on chick brooders is not new. In the past, however, it has been customary to use makeshift materials such as burlap sacking or discarded fabrics. Almost any of these was inefficient in reducing operating costs significantly. In addition, many of the makeshift curtain materials created a fire hazard.

Brooders heated by infrared lamps are becoming widely popular among producers owning flocks of 500 birds or less, and the low-cost-of-operation possibilities are beginning to interest some of the larger broiler producers. Larger operators now use hover-type electric brooders having a capacity for a batch of about 1,000 chicks.

Plywood-type brooders used

The brooders used in the experiment were of the homemade plywood type, fitted with four 250-watt lamps mounted under a 4′ x 4′ plywood top. Thermostats controlling the lamps were set to maintain the same air temperatures under all the brooders.

Tests were conducted in four 10′ x 12′ insulated colony houses—2 with fixed, insulated sash, 2 with 6-pane movable sash windows and in a 26′ x 132′ house with seven 12′ x 26′ pens separated by wire partitions. ☆



CURTAINS cut brooding costs by about half in test. Brooder without curtains (below) used 92.6 percent more energy than brooder with curtain of aluminum sheeting (left, raised in front). Also used successfully were white and vinyl plastic. Brooders are 4′ x 4′ plywood; each has four 250-watt infrared lamps.

BEAN STORAGE and YIELDING ABILITY

■ UNFAVORABLE SEED STORAGE causes some of the unthriftiness and poor yields that trouble growers of snap beans and other crops.

Bush beans were reduced by half in plant height and a fourth in weight of pods and plants following prolonged unfavorable seed storage in tests at USDA's Agricultural Research Center, Beltsville, Md. This helps explain differences in plant vigor that have perplexed seedsmen, growers, and processors for years.

High humidity and warm temperatures in storage—especially when the warmth is maintained for a long time or coupled with high humidity—are known to cause low germination, abnormal development, or even death of seeds. Under less extreme conditions, the seeds remain viable but develop plants that are weakened for life, the Beltsville experiments show.

Well-stored seeds of three bean varieties—Plentiful, Black Valentine, and Brittle Wax—germinated promptly and grew rapidly. They used up the stored food in the cotyledons and shed them within 10 to 11 days. But ARS plant physiologists E. H. and V. K. Toole and H. A. Borthwick observed that certain poorly-stored seeds produced slow-growing seedlings that used only about a fourth of the stored nourishment before cotyledon drop. Those seedlings failed to obtain most of the stored food that they needed to get them off to a good start.

The weakened plants continued to grow slowly, reaching maturity several days late, and produced shorter internodes and about one less internode per plant. Total pod weight was cut 27 to 30 percent in these beans.

The better lots of seeds were stored in a naturally dry warehouse in Idaho. The poorer ones were stored in a warehouse in a hot, humid part of Texas and kept constantly at 66° F. and 57 percent humidity—satisfactory conditions for short-time storage but not for long periods. Seeds for this experiment were stored for the rather long period of 4 years, however, to accentuate lesser differences that occur after only 2 years of storage. ☆

BEAN STORAGE and EATING QUALITY

■ KEEPING QUALITY of dry beans in storage is markedly affected by moisture content, say USDA researchers H. J. Morris and Elizabeth R. Wood.

Under cool, dry storage conditions, dry beans keep well, deteriorate very slowly. Under warm moist storage conditions, they deteriorate rapidly, losing flavor and texture.

Investigation at the ARS Western Utilization Research Branch, Albany, Calif., showed that flavor and texture of dry beans containing 14 to 16 percent moisture deteriorate significantly in 6 months at 77° F. In 12 months, such beans are unpalatable.

Beans of 5 to 10 percent moisture maintained their eating quality quite well for 2 years at 77° F., almost as well as comparable samples stored for an equal time at −10° F.

The oil or fat in beans, amounting to about 2 percent, contains a small quantity of acid. Researchers devised a way to measure this acid and noted that it increased as beans lost eating quality. Allowing for variation in amount of oil acid in different varieties of beans, increases in acid generally proved to be a useful index of quality. As oil acid increased, flavor and texture decreased.

With large losses in quality, there usually were significant losses in the activities of the enzymes catalase and and phosphatase. Loss in enzyme activity, however, was not correlated as well with loss in eating quality as was increase in oil acid.

Seven varieties of beans were used for tests: Great Northern, large lima, Michelite, pinto, red kidney, red Mexican, and California small white.

Moisture content also influenced color. Pintos containing 13 and 15 percent moisture darkened greatly after one year's storage. The color of pintos containing 10.4 percent moisture and below compared favorably with the color of control beans stored at −10° F. There was some change in low-moisture samples, too; but generally, the lower the moisture content, the smaller the color change. ☆

CHOOSE THE RIGHT DETERGENT

Fabric, dye, soil, and water should each be considered in choosing detergent that fits a given laundering situation

■ No ONE DETERGENT is best for all laundering jobs, USDA research shows. Each kind of detergent has different cleaning ability suited to a specific laundering situation. Best results in home laundering depend largely on choosing the right detergent for the article to be washed. The choice should be guided by the kind of fiber in the fabric, the colorfastness of the dye, the amount of soil, and whether the water is soft or hard.

So says ARS textile chemist Margaret S. Furry, who studied effects on various fabrics of many widely used household detergents—soaps and synthetic detergents ("syndets"). Some findings are given as recommendations to homemakers in USDA Home and Garden Bulletin 49, "Detergents for Home Laundering."

In determining the effect of detergents, the textile chemists wash small samples of the test cloth separately in an experimental washing machine called a Launder-ometer. Temperature is accurately controlled for both wash and rinse waters. Several different concentrations of each detergent are tried in soft and in hard water, at warm as well as high temperature, for different lengths of time and varying amounts of agitation.

Before washing, the researchers measure the reflectance or color of the fabric with a color-difference meter. Samples are marked so shrinkage can be measured, and fabric strength and elasticity are determined with laboratory instruments. The same measurements, repeated after washing and compared with original values, reveal any effect of detergent and washing method on fabric properties.

It helps water do the job

How does a detergent work? It helps water wet the fabric and dirt. Then, after agitation has loosened and broken up dirt particles, the detergent solution holds them in suspension so they cannot settle back on the fabric before being rinsed away.

Some soaps and syndets contain added alkaline chemicals, often called builders, which help to overcome the effect of hard water, increase sudsing, and improve the cleaning action.

Thus, there are four types of detergents available to homemakers—unbuilt and built soaps and unbuilt and built synthetic detergents. The unbuilt products, lacking the alkaline chemicals, are well suited to launder-

COLOR-DIFFERENCE meter measures reflectance, color of fabrics. Readings before and after washing show changes due to the treatment.

LAUNDER-OMETER washes fabric samples under controlled conditions so effects of methods or materials under test can be compared.

ing lightly soiled fine fabrics. And the built soaps and synthetic detergents are good for the family wash and for heavily soiled materials.

The researchers report that in soft water, both built and unbuilt soaps and some high-sudsing built syndets were more effective in removing soil from cotton and fabrics of manmade fibers than were the unbuilt syndets. In hard water, both unbuilt and built syndets were more efficient than soaps. In hot water, the soaps removed about one-third more soil than in warm water. Syndets also were generally more effective in hot water.

Tips given for wool, silk

For laundering wool, silk, or blends of these with other fibers, the researchers advise using unbuilt synthetic detergents. Only this type is nonalkaline in solution and therefore safest for wool and silk and some dyes that an alkaline product might harm. For example, samples of dyed wool challis washed 10 times with alkaline products—soaps and built syndets—showed chemical damage to the fiber and faded more than samples similarly washed with an unbuilt syndet. Also, results showed that the degree of shrinkage in wool depends more on the agitation during washing than on the kind of detergent used.

On the other hand, undyed fabrics of manmade fibers such as Acrilan, Dacron, Dynel, nylon, and Orlon shrank little. Laundering 75 times caused only slight loss in strength. Most fabrics showed no significant change in whiteness after repeated washing with any soaps or syndets but Orlon yellowed slightly.

Bulletin lists detergents

To help homemakers select the type detergent they need, Home and Garden Bulletin 49 includes a partial list of brands of unbuilt and built soaps and unbuilt and built synthetic detergents on the retail market. ☆

SPREADING THE WORD ON NUTRITION

■ THERE IS STILL great need to get factual information on nutrition to individuals and families in a form they can and will apply. Although diets in general have improved during the past few decades, there are still some people who do not know what constitutes a good diet. Others are confused by claims made for special foods and fad diets. Bizarre and sometimes harmful weight-control diets attract numerous followers.

Many organizations have made nutrition teaching an important part of their work—to help persons untrained in nutrition separate reliable facts from misinformation. To coordinate and strengthen the many programs, the nutritionists concerned and others interested in health and well-being organized nutrition committees. These form a common meeting ground; through the committees, members can work effectively together and present a unified interpretation of nutrition findings.

USDA, charged with disseminating results of research as well as conducting it, is represented on the Federal nutrition committee—the Interagency Committee on Nutrition Education and School Lunch (ICNESL)—by Agricultural Research Service, Agricultural Marketing Service, Federal Extension Service, and Foreign Agricultural Service.

ARS representatives Sadye F. Adelson and Esther F. Phipard provide a direct channel between the researchers in foods and nutrition and the education members of this Federal nutrition group. In addition, ARS Nutrition Programs Service acts as secretariat for ICNESL.

Other agencies represented are Children's Bureau, Office of Education, Public Health Service, Bureau of Indian Affairs, Bureau of Fisheries, American National Red Cross, International Cooperation Administration, and UN Food and Agricultural Organization.

ICNESL maintains contact with its counterparts, the State and community nutrition committees. Together, ICNESL members and the people they work with reach a greater number and variety of persons with nutrition information than any one organization could alone.

Through the years, nutrition committees have sponsored conferences, publicized the value of bread and flour enrichment, emphasized need for good breakfasts, and promoted and assisted in nutrition education for children and adults. Committees have vigorously supported school lunch activities—cooperating in workshops to train cooks and workers, planning menus, arousing public interest. At present, committees are giving much attention to motivation research—how to stimulate individuals and groups to follow food practices that lead to good nutrition. ☆

Exploring in Far East

Ornamental plants of possible value to this country's gardens are being collected by USDA in southern Japan, including the Ryukyu Islands.

ARS plant explorer J. L. Creech, in charge of the U. S. Plant Introduction Gardens, Glenn Dale, Md., is in Japan and will be returning about mid-January. The expedition is financed jointly by ARS and Longwood Foundation, Kennett Square, Pa.

Creech made an earlier search for plants in the Ryukyus in 1955. He found an abundance of very desirable ornamental plants that aren't grown in Americas—some species that are new to us and varied forms of other species already growing here. Little-known plants with appeal for our extensive nursery and florist industries are Creech's special objective.

Many of our popular and successful ornamentals—including hardy azaleas, camellias, flowering cherries, and showy hollies—came from small collections originally made many years ago in Japan, other Far-East islands, and the Asiatic mainland. Creech has found many types of these species growing there and possessing a variety of plant and leaf forms, flower types, and climatic adaptabilities.

Creech also found that Japanese plant breeders have many improved varieties and strains that would be valuable to our country. It is hoped through this expedition to acquire some of these varied forms and equally desirable new species with wide adaptation in the United States.

Toward better poultry

Changes in the National Poultry and Turkey Improvement Plans provide greater conformity to new developments in breeding and in control of hatchery-disseminated diseases.

The plans are designed to make available stock possessing superior egg and meat production qualities.

One NPIP change effective in October divides the advanced breeding phase into two sections—the Record-of-Performance (ROP) program,

based on qualification of females as either individuals or families, and the Performance-Tested Parent Stock program, based on qualification of flocks in central random-sample tests.

A change that becomes effective July 1, 1957, provides that only polyvalent pullorum antigen, which detects all types of the disease, is to be used in NPIP whole-blood tests.

Reflecting growing interest in performance testing under the NTIP, numerous changes were made in the procedure for conducting and reporting on turkey performance tests.

Another NTIP change is addition of overall market quality as a factor in determining qualification for Performance-Tested Parent Stock.

The way to thin pears

Hand thinning to increase size and yield of Bartlett pears—a variety that doesn't self-thin—is an old practice. Recent USDA studies show, however, that the most common thinning methods don't get best results.

Bartletts tend to produce too many fruits for good size. Thinning the young crop lets fruits grow larger. But ARS plant physiologists R. J. Higdon and J. H. Grim found in work at Medford, Oreg., that a pear undersize at thinning time rarely becomes a large one by harvest.

In the Medford study, the usual space-thinning practice—leaving the terminal pear and a fruit about every 8 inches on the limb—increased yield of box-size fruit (135 to the box and larger) by only 1 or 2 percent over yield from unthinned trees. Such thinning sacrificed many larger pears and retained some small ones with limited growth potential.

On the other hand, selective thinning—removing defective and smaller-than-average fruits and leaving about 1 pear per 50 leaves regardless of proximity of fruit and leaves—boosted yield of 135-and-larger fruit by a third (3½ tons per acre). Even where clusters were left, branches were generally strong enough to hold the fruit, and size wasn't decreased.

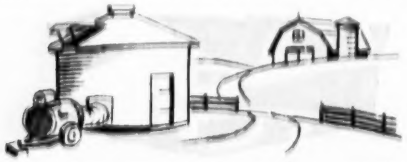
Shell—store for less

Corn growers stretch both space and the dollar when they use field shelling and artificial drying machinery. These are the results of a study of Illinois farms where all or part of the crop was harvested and stored on the farm as shelled corn. The survey was made by USDA agricultural economists R. N. Van Arsdall and Velmar Davis in cooperation with the Illinois experiment station.

Less than one-half of 1 percent of the mechanical pickers in the State were field shellers at the time of the survey. Yet, farmers with such equipment found they could provide shelled corn storage and buy a drier for the same or lower cost than they could erect cribs for ear corn.

Storage costs are reduced, since shelled corn occupies less space than ear corn. And loss is smaller on shelled corn stored in tight bins than

on ear corn stored in conventional cribs. This is particularly true when the bins are structurally sound, the moisture content 13 percent or below,



and the corn clean and properly cooled. The study also shows there is less crusting, spoilage, insect infestation, and rodent damage.

These advantages are partially offset at low volumes by high costs of drying. But in production of 10,000 or more bushels of corn, total costs are less with field shelling and artificial drying than with mechanical picking and ear-corn storage.

Wait can save water

A dry-bean crop can show drought signs up to 8 days or more during critical periods without suffering a decline in yield. By using this research information, bean growers in irrigation areas can save water.

Eight days of moisture stress did not reduce yields when permitted before the bloom stage, according to a cooperative study at Prosser, Wash., by USDA and the Washington experiment station. Moisture stress for about 12 days during blooming or 10 days while maturing didn't lower yield but did stunt the vines some.

ARS soil scientist J. S. Robins and agronomist C. E. Domingo found, however, that bean yield will be lowered by about 20 percent if the crop is allowed to continue under moisture stress for 15 days just before the bloom period, for 18 to 22 days during blooming, or for the 20 days just before pods begin to ripen.

A change of color from the light green of succulent plants to a dark blue-green is a sign that the plant is beginning to suffer from a shortage of moisture. Yield is affected variously, depending on when the dryness occurs—in the prebloom stage, by fewer pods; in the bloom stage, by fewer pods and beans per pod; and during maturation, by smaller beans.

Keep cool—hold color

Commercially-canned tart red cherries will retain their extra good look and flavor for as long as a year if stored at low temperatures.

Tests by chemists R. T. Whittenberger and C. H. Hills at the USDA Eastern Utilization Research Branch, Philadelphia, Pa., showed that cherries kept their good color for 2 to 3 months when stored at 75° F. But after 6 months at this temperature, their brightness was gone and they had lost much of their color appeal.

Cherries stored at 35° F., however, retained their bright red color and their flavor for 6 months and were still attractive even after 1 year's storage. This low temperature slows down chemical reactions and minimizes loss of red pigment. It also inhibits destruction of flavor.

Further tests showed that the loss in redness associated with storing fresh, unbruised cherries was insignificant compared to the loss during normal storage of the canned product. Storing the fresh cherries in air at 35° F. for 3 weeks before processing caused some loss of red pigment. This loss, however, was less than that occurring in the canned product during storage for 1 month at 75° F.

No budworm resistance

The kind of duster used, and not an acquired resistance to DDT, has been responsible for apparent ineffectiveness of DDT used against the tobacco budworm. This insect is very destructive of a high-value crop.

In cooperative studies this year by USDA and the South Carolina experiment station at Florence, S. C., the recommended 10-percent DDT dust gave good budworm control when applied directly to the tobacco buds with small plunger dusters. This application protected the plants for several days, even when put on in a heavy wind or followed by a 0.3-inch rain.

Some large-scale tobacco growers in the Southeast have been getting poor control of the pest with this dust. They applied it with power and rotary hand dusters. This equipment

spreads the dust thin and doesn't concentrate enough on the buds where needed. So it's clear now why such treatments were unsuccessful, whereas many small growers succeeded.

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